

What is claimed is:

1. A plating apparatus comprising:

a plating section for performing a plating process  
with the use of a plating liquid for plating a substrate  
5 with copper, the plating section having an insoluble anode;

a copper dissolution tank connected to the plating  
section for communication of the plating liquid with the  
plating section and accommodating therein a copper supply  
source composed of a copper wire; and

10 a first circulation mechanism for circulating the  
plating liquid through the plating section and the copper  
dissolution tank.

2. A plating apparatus as set forth in claim 1, wherein  
the plating section comprises:

15 a plating vessel for containing the plating liquid  
to be brought into contact with the substrate;

a plating liquid container capable of containing  
the plating liquid in a greater amount than the plating  
vessel; and

20 a second circulation mechanism for circulating the  
plating liquid through the plating vessel and the plating  
liquid container,

wherein the copper dissolution tank is connected  
to the plating section via the plating liquid container.

25 3. A plating apparatus as set forth in claim 1, wherein

the copper supply source comprises a plurality of mesh members each prepared by weaving a copper wire, the mesh members being stacked one on another along a flow path of the plating liquid in the copper dissolution tank.

5 4. A plating apparatus as set forth in claim 1, wherein the copper dissolution tank comprises a cartridge accommodating therein the copper supply source, and having a plating liquid inlet port for introducing the plating liquid and a plating liquid outlet port for discharging  
10 the plating liquid, the cartridge being detachable from the plating apparatus.

5. A plating apparatus comprising:

a plating section for performing a plating process with the use of a plating liquid for plating a substrate  
15 with copper, the plating section having an insoluble anode;

a copper dissolution tank connected to the plating section for communication of the plating liquid with the plating section and accommodating therein a copper supply source;

20 a circulation mechanism for circulating the plating liquid through the plating section and the copper dissolution tank;

a replacement liquid supplying section for supplying a replacement liquid into the copper dissolution  
25 tank for prevention of deterioration of a surface of the

copper supply source; and

a control section which performs a control operation to circulate the plating liquid through the plating section and the copper dissolution tank when the plating process is performed in the plating section and to stop the circulation of the plating liquid and replace the plating liquid in the copper dissolution tank with the replacement liquid supplied from the replacement liquid supplying section after completion of the plating process in the plating section.

6. A plating apparatus as set forth in claim 5, further comprising a deionized water supplying section for supplying deionized water into the copper dissolution tank, wherein the control section performs a control operation so as to replace the plating liquid in the copper dissolution tank with deionized water and then replace the deionized water with the replacement liquid after the completion of the plating process in the plating section.

7. A plating apparatus as set forth in claim 5, wherein the copper supply source comprises a plurality of mesh members each prepared by weaving a copper wire, the mesh members being stacked one on another along a flow path of the plating liquid in the copper dissolution tank.

8. A plating apparatus as set forth in claim 5, wherein the copper dissolution tank comprises a cartridge

accommodating therein the copper supply source, and having a plating liquid inlet port for introducing the plating liquid and a plating liquid outlet port for discharging the plating liquid, the cartridge being detachable from  
5 the plating apparatus.

9. A plating apparatus comprising:

a plating section for performing a plating process with the use of a plating liquid for plating a substrate with copper, the plating section having an insoluble anode;

10 a plurality of copper dissolution tanks connected to the plating section for communication of the plating liquid with the plating section and each accommodating therein a copper supply source;

a circulation mechanism for circulating the plating  
15 liquid through the plating section and the copper dissolution tanks;

a weight measuring section for individually measuring weights of the copper dissolution tanks; and

a control section which performs a control operation  
20 so as to select at least one of the copper dissolution tanks for use in the plating process on the basis of the result of the measurement performed by the weight measuring section and circulate the plating liquid through the selected copper dissolution tank and the plating section.

25 10. A plating apparatus as set forth in claim 9, wherein

the control section calculates weights of the copper supply sources in the respective copper dissolution tanks on the basis of the result of the measurement performed by the weight measuring section, and select one of the copper dissolution tanks having the lightest copper supply source for use in the plating process.

11. A plating apparatus as set forth in claim 9, wherein the copper supply source comprises a plurality of mesh members each prepared by weaving a copper wire, the mesh members being stacked one on another along a flow path of the plating liquid in each of the copper dissolution tanks.

12. A plating apparatus as set forth in claim 9, wherein the copper dissolution tanks each comprise a cartridge accommodating therein the copper supply source, and having a plating liquid inlet port for introducing the plating liquid and a plating liquid outlet port for discharging the plating liquid, the cartridge being detachable from the plating apparatus.

13. A cartridge removably attachable to a plating apparatus having an insoluble anode for copper plating and adapted to supply copper ions to a plating liquid for use in the plating apparatus, the cartridge comprising a plating liquid inlet port for introducing the plating liquid, a plating liquid outlet port for discharging the plating liquid, and a copper supply source composed of a

copper wire accommodated therein.

14. A cartridge as set forth in claim 13, wherein the copper supply source is disposed across a flow path of the plating liquid in the cartridge.

5 15. A cartridge as set forth in claim 13, wherein the copper supply source comprises a plurality of mesh members each prepared by weaving a copper wire, the mesh members being stacked one on another along the flow path of the plating liquid in the cartridge.

10 16. A cartridge as set forth in claim 13, wherein the copper supply source has a void ratio of not smaller than 30%.

17. A plating method comprising the steps of:

15       plating a surface of a substrate with the surface thereof coming in contact with a plating liquid in a plating section having an insoluble anode; and

          circulating the plating liquid through the plating section and a copper dissolution tank accommodating therein a copper supply source composed of a copper wire.

20 18. A plating method as set forth in claim 17,

          wherein the plating section comprises a plating vessel which contains the plating liquid to be brought into contact with the substrate, and a plating liquid container capable of containing the plating liquid in a greater amount  
25 than the plating vessel,

wherein the plating step comprises the step of performing the plating process with the substrate in contact with the plating liquid contained in the plating vessel,

5            wherein the plating liquid circulating step comprises the steps of circulating the plating liquid through the plating vessel and the plating liquid container, and circulating the plating liquid through the plating liquid container and the copper dissolution tank.

10 19.       A plating method comprising the steps of:

             plating a surface of a substrate with the surface thereof coming in contact with a plating liquid in a plating section having an insoluble anode;

             circulating the plating liquid through the plating  
15 section and a copper dissolution tank accommodating therein a copper supply source in the plating step; and

             replacing the plating liquid in the copper dissolution tank with a replacement liquid for prevention of deterioration of a surface of the copper supply source.

20 20.       A plating method as set forth in claim 19, wherein the replacing step comprises the deionized water replacement step of replacing the plating liquid in the copper dissolution tank with deionized water, and the step of replacing the deionized water in the copper dissolution  
25 tank with the replacement liquid after the deionized water

replacement step.

21. A plating method comprising:

the plating step of plating a surface of a substrate  
with the surface thereof coming in contact with a plating  
5 liquid in a plating section having an insoluble anode;

the weight measuring step of individually measuring  
weights of plural copper dissolution tanks each  
accommodating therein a copper supply source;

the tank selecting step of selecting at least one  
10 of the copper dissolution tanks for use in the plating step  
on the basis of the result of the measurement performed  
in the weight measuring step; and

the step of circulating the plating liquid through  
the plating section and the copper dissolution tank  
15 selected in the tank selecting step.

22. A plating method as set forth in claim 21, wherein  
the tank selecting step comprises:

the copper weight calculating step of calculating  
weights of the copper supply sources in the respective  
20 copper dissolution tanks on the basis of the result of the  
measurement performed in the weight measuring step; and

the step of selecting one of the copper dissolution  
tanks having the lightest copper supply source for use in  
the plating step on the basis of the weights of the copper  
25 supply sources calculated in the copper weight calculating



step.

23. A copper dissolution tank connectable to a plating section for performing a plating process with the use of a plating liquid containing an oxidizing/reducing agent and copper ions for plating a substrate with copper, the copper dissolution tank comprising a copper supply source accommodated therein for supplying copper ions to the plating liquid for use in the plating section,

wherein the copper supply source is generally uniformly dissolvable over the entire surface thereof at a constant dissolution rate in the plating liquid, and is configured so that the surface area thereof is changed by a percentage of not greater than 25 % as observed from the start of dissolution of the copper supply source in the plating liquid till the copper supply source is dissolved to have a shape which is no longer generally conformable to an initial shape thereof.

24. A copper dissolution tank as set forth in claim 23, which is constructed so that the plating liquid flows along a predetermined flow path in the copper dissolution tank,

wherein the copper supply source which is generally uniformly dissolvable over the entire surface thereof at the constant dissolution rate in the plating liquid is configured so that the area of a surface thereof along the flow path is kept virtually constant from the start of the

dissolution of the copper supply source in the plating liquid till the copper supply source is dissolved to have a shape which is no longer generally conformable to the initial shape thereof.

5 25. A copper dissolution tank connectable to a plating section for performing a plating process with the use of a plating liquid containing an oxidizing/reducing agent and copper ions for plating a substrate with copper, the copper dissolution tank comprising a copper supply source  
10 accommodated therein for supplying copper ions to the plating liquid for use in the plating section, the copper dissolution tank being constructed so that the plating liquid flows along a predetermined flow path in the copper dissolution tank,

15 wherein the copper supply source comprises a copper supply source pipe disposed generally parallel to the flow path and having a pipe interior wall surface and a pipe exterior wall surface generally parallel to the flow path.

26. A copper dissolution tank as set forth in claim 25,  
20 wherein the copper supply source pipe includes a plurality of copper supply source pipes, the copper supply source pipes being arranged in the copper dissolution tank so that lengths of peripheral surfaces thereof in contact with the plating liquid as measured per unit area in a cross section  
25 intersecting the fluid path are virtually constant.

27. A copper dissolution tank connectable to a plating section for performing a plating process with the use of a plating liquid containing an oxidizing/reducing agent and copper ions for plating a substrate with copper, the  
5 copper dissolution tank comprising a copper supply source accommodated therein for supplying copper ions to the plating liquid for use in the plating section, the copper dissolution tank being constructed so that the plating liquid flows along a predetermined flow path in the copper  
10 dissolution tank,

wherein the copper supply source comprises a copper supply source plate disposed generally parallel to the flow path and having a pair of surfaces generally parallel to the flow path.

15 28. A copper dissolution tank as set forth in claim 27, wherein the copper supply source plate is configured so as to have a plurality of parallel plate portions which are arranged parallel to each other and generally parallel to the flow path,

20 wherein the parallel plate portions are generally equidistantly arranged with opposed surfaces thereof being spaced a predetermined distance.

29. A copper dissolution tank as set forth in claim 28, wherein the copper supply source plate is alternately  
25 folded along a plurality of bent portions each having a

ridge extending generally parallel to the flow path to configure the plurality of parallel plate portions.

30. A copper dissolution tank as set forth in claim 28, wherein the copper supply source plate is formed in a spiral  
5 shape as seen in cross section intersecting the flow path to configure the plurality of parallel plate portions.

31. A copper dissolution tank as set forth in claim 27, wherein the copper supply source plate includes a plurality of copper supply source plates, which are arranged in  
10 generally equidistantly spaced relation in a thickness direction of the copper supply source plates.

32. A copper dissolution tank as set forth in claim 27, wherein the copper supply source plate includes a plurality of planar copper supply source plates arranged generally  
15 parallel to each other, and corrugated copper supply source plates disposed between the planar copper supply source plates and each having a wavy cross section intersecting the flow path, the corrugated copper supply source plates each having ridges extending along the flow path.

20 33. A copper dissolution tank as set forth in claim 23, wherein the copper supply source has a surface area of 2000  $\text{cm}^2$  to 20000  $\text{cm}^2$  per kilogram before the dissolution of the copper supply source in the plating liquid is started.

34. A copper dissolution tank as set forth in claim 25,  
25 wherein the copper supply source has a surface area of 2000

cm<sup>2</sup> to 20000 cm<sup>2</sup> per kilogram before the dissolution of the copper supply source in the plating liquid is started.

35. A copper dissolution tank as set forth in claim 27, wherein the copper supply source has a surface area of 2000  
5 cm<sup>2</sup> to 20000 cm<sup>2</sup> per kilogram before the dissolution of the copper supply source in the plating liquid is started.

36. A plating apparatus comprising:

a plating section comprising a plating vessel for containing a plating liquid to be brought into contact with  
10 a to-be-treated substrate, the plating vessel having an insoluble anode disposed therein for electrical energization of the plating liquid, and a plating liquid container capable of containing the plating liquid in a greater amount than the plating vessel for circulating the  
15 plating liquid through the plating vessel and the plating liquid container; and

a copper dissolution tank accommodating therein a copper supply source for supplying copper ions to the plating liquid for use in the plating section;

20 wherein the copper supply source is generally uniformly dissolvable over the entire surface thereof at a constant dissolution rate in the plating liquid, and is configured so that the surface area thereof is changed by a percentage of not greater than 25 % as observed from the  
25 start of the dissolution of the copper supply source in

the plating liquid till the copper supply source is dissolved to have a shape which is no longer generally conformable to an initial shape thereof.

37. A plating apparatus comprising:

5 a plating section comprising a plating vessel for containing a plating liquid to be brought into contact with a to-be-treated substrate, the plating vessel having an insoluble anode disposed therein for electrical energization of the plating liquid, and a plating liquid  
10 container capable of containing the plating liquid in a greater amount than the plating vessel for circulating the plating liquid through the plating vessel and the plating liquid container; and

a copper dissolution tank accommodating therein a  
15 copper supply source for supplying copper ions to the plating liquid for use in the plating section, and constructed so that the plating liquid flows along a predetermined flow path in the copper dissolution tank;

wherein the copper supply source comprises a copper  
20 supply source pipe disposed generally parallel to the flow path and having a pipe interior wall surface and a pipe exterior wall surface generally parallel to the flow path.

38. A plating apparatus comprising:

a plating section comprising a plating vessel for  
25 containing a plating liquid to be brought into contact with

a to-be-treated substrate, the plating vessel having an insoluble anode disposed therein for electrical energization of the plating liquid, and a plating liquid container capable of containing the plating liquid in a greater amount than the plating vessel for circulating the plating liquid through the plating vessel and the plating liquid container; and

a copper dissolution tank accommodating therein a copper supply source for supplying copper ions to the plating liquid for use in the plating section, and constructed so that the plating liquid flows along a predetermined flow path;

wherein the copper supply source comprises a copper supply source plate disposed generally parallel to the flow path and having a pair of surfaces generally parallel to the flow path.